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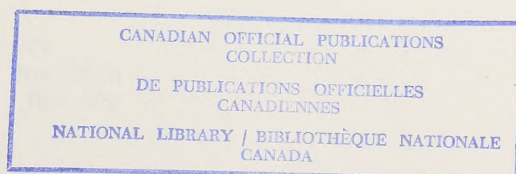
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Average Analysis of Alberta Feeds 1976-1980

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INTRODUCTION

Alberta Agriculture's Soil and Feed Testing Laboratory (ASFTL) has been analyzing feed samples submitted by Alberta farmers and ranchers since 1957. The purpose of the feed testing program is to determine nutrient concentrations in specific grains and roughages, and to recommend rations and management programs based on the analyses of the feeds and the information provided by the farmer.

Ideally, feeding recommendations should be made on the basis of specific feed analyses. However, feed companies and large-scale livestock producers find it infeasible to analyze all feeds which they use or purchase and, thus, must utilize mean (average) feed analysis data in ration formulation and feed purchasing. The data in this publication will be of assistance to people who require information on nutrient concentrations in feeds grown in the various areas of Alberta.

This publication contains a summary of analyses of feeds submitted by Alberta producers during the period of January 1, 1976 to December 31, 1980. All data, with the exception of bushel weight and moisture, are reported on a moisture-free (dry) basis. As well as reporting the average analyses for grains and roughages on a provincial basis, average analyses of certain feeds, where sample numbers are adequate, are also reported by soil area (see map on page 4).

While the mean concentrations of nutrients are perhaps the most meaningful data in this publication, special attention should be given to the ranges and standard deviations (S.D.). Nutritionists will usually formulate on the basis of mean values and coefficients of variation, unless they have analyses of the specific feeds being used.

Alberta feed manufacturers and feeders should be aware of the wide variations in concentrations of some nutrients in certain feeds, the minimal variation in others, and the differences in feed composition due to the area of the province in which the feeds are grown. However, caution must be exercised in using data where very few samples were received. Trends observed in these cases may not be realistic.

We hope that this publication will be of use to persons in the Alberta livestock industry. Nutritionists at the Soil and Feed Testing Laboratory would be pleased to receive any questions or comments you may have about this publication.

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GLOSSARY OF TERMS USED IN THIS PUBLICATION

ADF (Acid-detergent Fibre)

- The fibrous (least-digestible) portion of a roughage. The ADF fraction consists of lignin and cellulose. Roughages high in ADF are lower in digestible energy than roughages which contain low levels of ADF.

Carotene

- Precursor of vitamin A, found in plant material. For ruminants, 1 mg of carotene is equivalent to 400 IU vitamin A; for swine 1 mg of carotene is equivalent to 500 IU vitamin A. Carotene contents reported in this summary are for feeds received from January 1, 1976 to December 31, 1980.

Moisture-free Basis

- The concentration of a nutrient expressed on a moisture-free (dry) basis is the concentration of that nutrient in the completely dry portion of the feed. Expressing the nutrient content in this way allows us to make comparisons between feeds that have different moisture contents. In this publication, all values - except those of moisture, bushel weight and silage pH - are on a moisture-free (dry) basis.

To convert moisture-free (dry) values to as-fed values, use the following formula:

$$\text{Analysis(as-fed)} = \text{Analysis(dry)} \times \frac{(100 - \% \text{ Moisture})}{100}$$

Protein

- Values given in the tables are for total (crude) protein. Crude protein is calculated by multiplying the determined % nitrogen in a feed by 6.25.

Range

- The maximum and minimum nutrient concentrations observed in feed samples analyzed. Inaccurate identification of the sample by the farmer or the laboratory may have been responsible for the wide ranges observed in certain feed types.

GLOSSARY TERMS (Continued)

Soil Areas

- Major areas of the province that exhibit similar soil and climatic conditions, as defined by ASFTL (see map on page 4).

S.D. (Standard Deviation)

- A measure of dispersion of values.
Normally 66.7% of all values fall within plus or minus (\pm) one standard deviation from the mean while 95% of the values fall within (\pm) 1.96 standard deviations from the mean. For example, the mean bushel weight of barley in Alberta is listed in this publication (page 5) as 47.4 lb. Since the S.D. is 4.9 lb, two-thirds of the values for bushel weight in barley fall in the range of 42.5 - 52.3 lb (i.e. 47.4 ± 4.9) and 95% of the values fall in the range of 37.8 - 57.0 lb (i.e. $47.4 \pm 1.96 \times (4.9)$).
- Only values that were within ± 3 S.D. were used in compilation of averages.

Unsp.

- Unspecified.

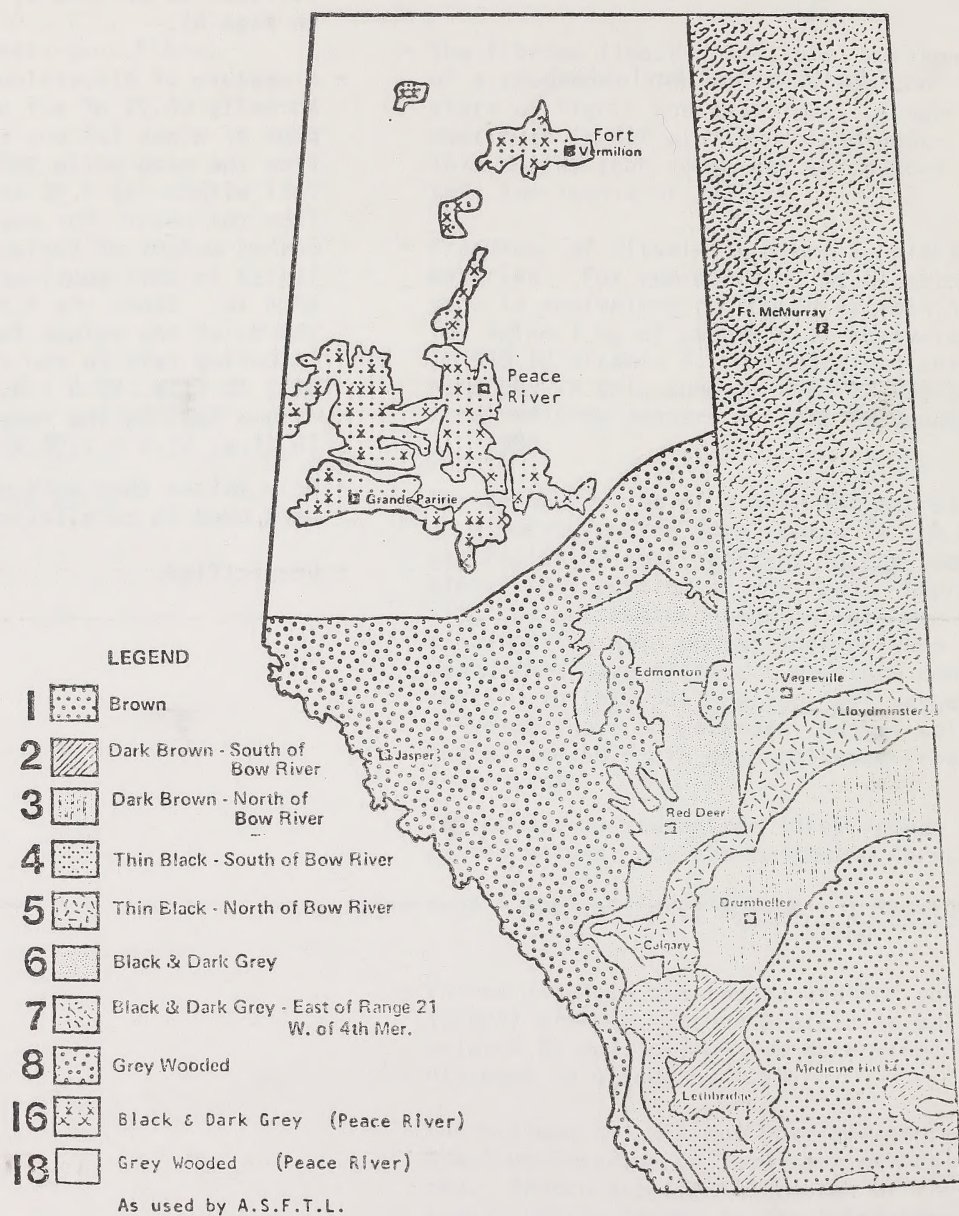


Figure 1. Soil zones of Alberta subdivided for feed and soil test areas.

Table 1. Regular feed analyses of GRAINS¹.

Feed Type	Number of Samples	Bushel Weight (lb)	Moisture (%)	Protein (%)	Calcium (%)	Phosphorus (%)
CEREALS						
Barley	3179	Mean	11.4	12.3	0.08	0.39
		Range	7.1-19.2	7.8-17.5	0.02-0.15	0.22-0.56
		S.D.	1.44	1.7	0.02	0.05
Oats	1508	Mean	9.8	11.6	0.10	0.36
		Range	5.8-13.9	7.0-17.5	0.01-0.15	0.09-0.61
		S.D.	1.3	1.8	0.01	0.05
Spring Wheat	176	Mean	11.6	15.8	0.06	0.39
		Range	6.8-16.4	9.7-20.9	0.02-0.14	0.22-0.54
		S.D.	1.5	1.8	0.02	0.06
Fall Wheat	36	Mean	10.5	12.9	0.05	0.34
		Range	8.4-14.0	9.5-16.9	0.01-0.06	0.24-0.65
		S.D.	1.5	1.4	0.01	0.07
Mixed Cereal	123	Mean	11.3	12.4	0.11	0.40
		Range	6.1-26.0	7.6-18.6	0.01-0.14	0.21-0.53
		S.D.	2.6	1.9	0.06	0.05
Utility Wheats	53	Mean	11.6	14.9	0.09	0.37
		Range	8.1-14.4	11.6-19.4	0.01-0.12	0.26-0.54
		S.D.	1.5	1.9	0.05	0.06

¹ Except for bushel weight, reported on a moisture-free basis.

Table 1. Regular feed analyses of GRAINS¹. (Cont'd)

Feed Type	Number of Samples	Bushel Weight (lb)	Moisture (%)	Protein (%)	Calcium (%)	Phosphorus (%)
OTHER GRAINS						
Fababeans	84	Mean	12.7	28.4	0.14	0.44
		Range	8.6-19.6	21.9-31.2	0.06-0.33	0.26-0.64
		S.D.	2.5	1.75	0.06	0.07
Field Peas	33	Mean	11.0	22.3	0.16	0.38
		Range	7.1-13.7	14.0-31.4	0.04-0.45	0.23-0.56
		S.D.	1.6	3.8	0.09	0.07
Rapeseed	17	Mean	7.0	22.4	0.48	0.64
		Range	52.-8.5	16.6-27.1	0.31-0.69	0.56-0.82
		S.D.	1.0	2.5	0.11	0.08
Triticale	13	Mean	10.1	16.8	0.11	0.39
		Range	8.2-11.8	13.3-22.2	0.03-0.26	0.33-0.46
		S.D.	1.1	2.2	0.07	0.04

¹ Except for bushel weight, reported on a moisture-free basis.

Table 2. Regular feed analyses by SOIL AREA for BARLEY GRAIN¹.

	Soil Area	Number of Samples	Bushel Weight (lb)	Moisture (%)	Protein (%)	Calcium (%)	Phosphorus (%)
	1	60					
Mean			48.8	10.7	13.0	0.08	0.36
Range			32.9-57.3	7.1-13.8	10.5-16.6	0.04-0.15	0.20-0.47
S.D.			4.6	1.2	1.5	0.03	0.06
	2	54					
Mean			48.8	10.3	13.4	0.07	0.35
Range			40.1-56.3	7.3-13.9	9.6-18.9	0.02-0.13	0.22-0.60
S.D.			3.3	1.2	2.0	0.02	0.08
	3	122					
Mean			49.7	11.1	12.8	0.08	0.35
Range			34.2-66.8	7.6-16.9	7.9-17.7	0.02-0.15	0.22-0.52
S.D.			4.1	1.4	1.8	0.03	0.06
	4	43					
Mean			50.7	10.7	12.6	0.08	0.35
Range			44.1-54.4	7.7-13.3	7.8-18.2	0.04-0.13	0.23-0.47
S.D.			2.9	1.1	2.2	0.03	0.06
	5	187					
Mean			47.9	11.8	12.9	0.08	0.55
Range			34.0-66.1	8.2-17.3	9.2-18.2	0.03-0.15	0.23-0.54
S.D.			5.0	1.5	1.7	0.01	0.06
	6	591					
Mean			46.6	11.5	12.5	0.09	0.40
Range			26.0-61.9	5.9-22.1	7.9-17.1	0.02-0.15	0.26-0.54
S.D.			4.9	1.6	1.6	0.01	0.05
	7	296					
Mean			47.1	11.9	12.1	0.08	0.40
Range			23.9-66.6	6.3-23.2	7.9-17.6	0.03-0.15	0.24-0.56
S.D.			5.8	1.9	1.8	0.02	0.05
	8	442					
Mean			46.7	11.5	11.7	0.09	0.41
Range			26.5-60.5	6.7-15.6	7.8-16.4	0.04-0.15	0.24-0.57
S.D.			4.8	1.3	1.5	0.03	0.05
	16	141					
Mean			48.1	11.4	11.9	0.08	0.38
Range			32.7-65.8	7.3-14.5	8.4-17.2	0.03-0.15	0.22-0.52
S.D.			4.6	1.3	1.9	0.03	0.06
	18	76					
Mean			46.8	11.7	11.5	0.08	0.38
Range			22.8-60.8	8.9-15.4	8.1-17.5	0.03-0.14	0.25-0.51
S.D.			4.5	1.4	1.9	0.03	0.06
Provincial Total		3179					
Mean			47.4	11.4	12.3	0.08	0.39
Range			22.8-71.9	7.1-19.2	7.8-17.5	0.02-0.15	0.22-0.56
S.D.			4.9	1.4	1.7	0.02	0.05

¹ Except for bushel weight, reported on a moisture-free basis.

Table 3. Regular feed analyses by SOIL AREA for OAT GRAIN¹.

Soil Area	Number of Samples	Bushel Weight (lb)	Moisture (%)	Protein (%)	Calcium (%)	Phosphorus (%)
1	55					
Mean		39.9	9.0	13.0	0.10	0.36
Range		28.7-53.6	7.6-12.0	9.9-15.6	0.06-0.15	0.27-0.47
S.D.		4.2	0.9	1.4	0.03	0.04
2	15					
Mean		38.4	9.0	13.2	0.11	0.36
Range		28.1-44.6	7.7-11.2	10.7-16.2	0.10-0.13	0.28-0.48
S.D.		4.1	1.0	1.7	0.01	0.06
3	83					
Mean		38.9	9.5	13.3	0.10	0.34
Range		26.0-49.9	7.0-14.3	9.0-19.0	0.05-0.14	0.22-0.50
S.D.		4.2	1.3	1.9	0.03	0.05
4	18					
Mean		39.0	9.3	11.8	0.10	0.35
Range		35.6-43.8	7.7-11.2	7.9-15.0	0.05-0.14	0.30-0.44
S.D.		2.5	1.0	1.9	0.03	0.04
5	124					
Mean		39.7	9.6	12.5	0.09	0.37
Range		22.3-57.1	6.3-14.6	8.9-18.0	0.05-0.15	0.25-0.55
S.D.		4.5	1.3	1.6	0.03	0.05
6	217					
Mean		40.5	9.9	12.1	0.10	0.37
Range		24.2-57.1	7.3-14.1	7.5-16.2	0.05-0.15	0.27-0.56
S.D.		4.4	1.3	1.6	0.03	0.05
7	149					
Mean		40.7	10.3	11.5	0.10	0.37
Range		20.4-53.4	6.3-13.8	7.8-15.8	0.06-0.15	0.26-0.50
S.D.		3.8	1.3	1.8	0.02	0.05
8	261					
Mean		40.0	9.9	10.8	0.10	0.36
Range		25.0-51.0	7.1-15.7	7.3-14.9	0.05-0.15	0.09-0.49
S.D.		3.5	1.5	1.5	0.02	0.05
16	60					
Mean		38.5	9.7	10.8	0.10	0.35
Range		29.7-47.8	7.4-12.5	7.7-14.9	0.06-0.15	0.24-0.45
S.D.		3.3	1.2	1.6	0.01	0.05
18	39					
Mean		38.0	9.8	10.3	0.09	0.35
Range		26.3-50.4	7.9-12.4	8.1-14.4	0.04-0.14	0.22-0.45
S.D.		4.9	1.2	1.4	0.02	0.05
Provincial Total	1508					
Mean		40.0	9.8	11.6	0.10	0.36
Range		27.1-51.8	5.8-13.9	7.0-17.5	0.01-0.15	0.09-0.61
S.D.		3.7	1.3	1.8	0.01	0.05

¹

Except for bushel weight, reported on a moisture-free basis.

Table 4. Regular feed analyses by SOIL AREA for SPRING WHEAT GRAIN¹.

	Soil Area	Number of Samples	Bushel Weight (lb)	Moisture (%)	Protein (%)	Calcium (%)	Phosphorus (%)
	1	13					
Mean			60.7	10.6	16.4	0.05	0.34
Range			50.2-64.5	9.4-14.1	14.1-20.9	0.04-0.06	0.23-0.44
S.D.			4.9	1.4	1.7	0.01	0.09
	2	9					
Mean			63.1	10.0	16.1	0.04	0.41
Range			60.8-64.8	9.3-11.2	12.6-19.0	0.01-0.05	0.36-0.46
S.D.			1.4	0.6	2.4	0.01	0.04
	3	14					
Mean			63.1	11.1	16.0	0.07	0.37
Range			55.2-67.7	9.8-14.7	13.3-18.6	0.06-0.08	0.29-0.43
S.D.			3.7	1.5	1.8	0.01	0.05
	4	7					
Mean			63.0	10.7	17.2	0.05	0.25
Range			61.9-65.6	10.1-12.0	15.2-18.7	0.02-0.05	0.22-0.29
S.D.			1.5	0.7	1.2	0.01	0.02
	5	19					
Mean			61.1	11.5	16.5	0.08	0.39
Range			49.1-66.9	10.0-16.4	14.1-19.2	0.01-0.08	0.29-0.54
S.D.			4.9	1.5	1.5	0.02	0.07
	6	15					
Mean			57.9	12.0	16.2	0.08	0.39
Range			51.8-66.6	9.6-14.9	14.5-20.5	0.04-0.14	0.35-0.42
S.D.			4.1	1.4	1.6	0.03	0.02
	7	39					
Mean			59.5	11.8	15.6	0.08	0.39
Range			53.9-66.6	6.8-15.9	12.3-18.7	0.04-0.11	0.30-0.47
S.D.			3.2	1.7	1.7	0.02	0.04
	8	19					
Mean			61.2	11.8	15.3	0.09	0.43
Range			55.0-65.3	8.7-14.0	13.6-17.7	0.04-0.14	0.38-0.48
S.D.			2.5	1.3	1.3	0.03	0.03
	16	10					
Mean			58.7	12.3	15.4	0.05	0.40
Range			46.5-65.3	10.8-15.1	12.6-19.4	0.04-0.07	0.32-0.45
S.D.			5.6	1.3	2.0	0.01	0.04
	18	6					
Mean			60.9	13.1	13.8	0.04	0.41
Range			56.5-64.5	12.0-14.2	12.5-15.1	0.03-0.05	0.39-0.45
S.D.			3.7	0.8	0.9	0.01	0.02
Provincial Total 176							
Mean			60.6	11.6	15.8	0.05	0.36
Range			45.4-67.7	6.8-16.4	9.7-20.9	0.02-0.14	0.09-0.61
S.D.			4.2	1.5	1.8	0.02	0.05

¹

Except for bushel weight, reported on a moisture-free basis.

Table 5. Regular feed analyses for LEGUME HAYS (moisture-free basis).

Feed Type	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
LEGUMES						
Legume (unsp.)	13	Mean	19.1	31.4	1.79	0.23
		Range	13.2-24.3	22.5-40.0	1.22-2.37	0.17-0.31
		S.D.	3.6	5.2	0.33	0.05
Alfalfa	2297	Mean	17.9	34.9	1.87	0.23
		Range	8.2-27.8	15.5-52.1	0.31-3.38	0.08-0.39
		S.D.	3.2	5.5	0.49	0.05
Clover (unsp.)	216	Mean	15.0	42.5	1.44	0.22
		Range	7.3-24.0	23.5-60.5	0.36-2.61	0.09-0.52
		S.D.	3.1	7.4	0.35	0.07
Red Clover	124	Mean	14.8	43.7	1.46	0.21
		Range	7.5-21.4	26.3-60.5	0.36-2.35	0.09-0.43
		S.D.	2.9	7.3	0.37	0.06
Alsike Clover	39	Mean	16.6	40.0	1.43	0.27
		Range	9.1-25.3	26.7-51.5	0.85-2.17	0.11-0.52
		S.D.	4.1	7.0	0.27	0.08
Sweet Clover	38	Mean	16.4	38.9	1.48	0.22
		Range	5.5-23.5	22.8-66.0	22.8-66.0	0.10-0.35
		S.D.	4.4	9.2	9.2	0.07

Table 6. Regular feed analyses for LEGUME-GRASS MIXTURES and GRASS HAYS (moisture-free basis).

Feed Type	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
LEGUME-GRASS MIXTURES						
Legume-Grass	4454	12.1 2.0-30.2 4.1	12.7 2.9-24.3 3.8	37.6 20.2-53.9 5.3	1.14 0.11-2.90 0.55	0.19 0.04-0.37 0.05
Alfalfa-Grass	2759	11.8 2.0-22.3 3.5	13.7 4.0-24.8 3.6	36.7 21.2-51.6 5.2	1.31 0.15-3.09 0.56	0.20 0.06-0.35 0.05
GRASSES						
Grass (unsp.)	153	11.2 4.2-26.2 3.9	10.4 3.0-21.4 3.8	37.7 27.0-49.2 4.9	0.73 0.23-1.81 0.33	0.18 0.02-0.38 0.07
Native Grass	134	10.1 6.1-22.3 3.2	8.4 3.3-17.0 2.8	39.3 29.6-49.2 4.0	0.53 0.19-1.12 0.21	0.14 0.02-0.33 0.06
Slough Grass	95	10.6 4.3-25.5 3.9	9.5 3.1-17.8 2.4	38.2 28.3-51.0 4.4	0.58 0.19-1.29 0.21	0.15 0.04-0.31 0.06
Brome Grass	253	10.8 5.9-23.0 3.5	9.9 3.7-19.6 3.2	37.5 27.6-47.4 3.8	0.61 0.17-1.54 0.26	0.17 0.05-0.42 0.06

Table 6. Regular feed analyses for LEGUME-GRASS MIXTURES and GRASS HAYS (moisture-free basis). (Cont'd)

Feed Type	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
<u>GRASSES (Cont'd)</u>						
<u>Timothy</u>						
	239	11.2	9.1	38.9	0.58	0.17
		4.0-31.5	2.4-15.9	28.4-52.7	0.15-1.28	0.04-0.34
		4.2	2.8	4.4	0.22	0.05
<u>Creeping Red Fescue</u>						
	15	7.9	9.7	36.0	0.70	0.20
		6.6-9.9	6.2-16.0	30.0-41.8	0.44-1.14	0.11-0.27
		1.1	2.7	3.5	0.19	0.04
<u>Crested Wheatgrass</u>						
	18	8.4	9.0	38.1	0.43	0.18
		6.8-10.9	4.6-15.5	31.1-46.0	0.12-1.0	0.07-0.41
		1.1	3.2	3.1	0.24	0.09
<u>Reed Canarygrass</u>						
	32	10.8	11.8	36.4	0.55	0.21
		6.4-17.6	5.3-24.3	29.4-46.8	0.21-1.16	0.07-0.32
		3.2	5.0	4.3	0.21	0.07
<u>Russian Wildrye</u>						
	8	8.7	10.2	39.9	0.48	0.13
		7.4-10.1	6.5-13.8	31.0-48.9	0.21-0.99	0.06-0.28
		0.8	2.4	5.6	0.25	0.07

Table 7. Regular feed analyses for CEREALS and OTHER HAYS (moisture-free basis).

Feed Type	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
CEREALS						
Barley	204	Mean	10.0	33.1	0.47	0.23
		Range	4.1-19.3	8.7-48.4	0.15-1.16	0.08-0.37
		S.D.	3.0	6.2	0.23	0.06
Oats	760	Mean	9.4	35.4	0.36	0.21
		Range	2.3-17.8	19.7-51.1	0.08-0.89	0.03-0.38
		S.D.	2.7	5.5	0.14	0.06
Wheat	21	Mean	9.8	36.1	0.27	0.20
		Range	7.0-12.7	27.2-43.7	0.07-0.65	0.09-0.34
		S.D.	1.6	4.4	0.14	0.06
Mixed Cereal	42	Mean	9.9	36.7	0.51	0.23
		Range	2.9-19.4	26.9-49.5	0.19-0.99	0.11-0.37
		S.D.	3.8	5.6	0.20	0.07
OTHER HAYS						
Weeds	11	Mean	15.7	37.1	1.16	0.29
		Range	3.2-31.3	13.4-58.3	0.44-1.75	0.13-0.76
		S.D.	7.4	11.6	0.43	0.17

Table 8. Regular feed analyses by SOIL AREA for ALFALFA HAY (moisture-free ba

Soil Area	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
1	206					
Mean		11.8	19.9	34.5	1.76	0.24
Range		6.8-21.4	10.4-27.8	20.1-48.8	0.87-2.43	0.10-0.39
S.D.		2.9	3.0	5.0	0.31	0.05
2	116					
Mean		11.2	19.1	33.9	1.79	0.23
Range		5.6-22.1	11.3-25.7	20.4-46.7	0.84-2.87	0.10-0.37
S.D.		2.7	2.9	4.9	0.35	0.05
3	31					
Mean		12.1	18.6	34.3	1.90	0.22
Range		6.0-21.1	11.3-25.7	23.2-51.6	0.95-3.18	0.13-0.35
S.D.		4.2	3.4	5.7	0.58	0.06
4	43					
Mean		10.9	18.0	32.3	1.96	0.20
Range		7.0-18.2	12.4-22.7	23.2-46.7	0.90-3.01	0.12-0.29
S.D.		2.4	2.9	5.9	0.52	0.05
5	41					
Mean		12.3	19.2	30.8	2.14	0.22
Range		8.1-20.1	11.9-23.9	24.0-49.2	1.27-3.16	0.12-0.32
S.D.		2.8	3.4	6.0	0.60	0.05
6	224					
Mean		12.2	17.4	34.7	2.06	0.21
Range		6.6-23.4	6.6-24.5	21.7-50.7	0.42-3.69	0.11-0.36
S.D.		3.8	3.1	5.8	0.59	0.05
7	59					
Mean		12.5	17.7	35.2	2.07	0.21
Range		6.2-24.2	8.7-24.7	19.7-52.8	0.91-3.95	0.09-0.34
S.D.		4.5	3.2	6.7	0.61	0.05
8	129					
Mean		12.6	17.4	35.9	1.94	0.24
Range		7.0-26.9	5.8-25.9	18.7-49.5	0.54-3.67	0.12-0.37
S.D.		4.4	3.7	5.9	0.64	0.05
16	32					
Mean		11.1	17.9	35.8	1.77	0.21
Range		6.1-19.6	9.0-23.9	27.1-50.7	0.62-2.39	0.11-2.39
S.D.		3.3	3.4	5.0	0.41	0.05
18	40					
Mean		10.3	19.0	32.5	2.18	0.23
Range		4.9-18.7	8.4-25.7	23.8-50.3	0.44-3.14	0.14-0.40
S.D.		3.5	4.0	6.4	0.60	0.05
Provincial Total	2297					
Mean		10.7	17.9	34.9	1.87	0.23
Range		3.4-29.8	8.2-27.8	15.5-52.1	0.31-3.38	0.08-0.39
S.D.		3.9	3.2	5.5	0.49	0.05

Table 9. Regular feed analyses by SOIL AREA for ALFALFA-GRASS HAY
(moisture-free basis).

Soil Area	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
1	110					
Mean		10.5	14.5	36.0	1.27	0.19
Range		7.0-20.1	6.4-23.6	24.4-50.0	0.41-2.79	0.08-0.31
S.D.		2.5	4.0	4.8	0.48	0.05
2	67					
Mean		11.2	16.8	35.3	1.47	0.22
Range		6.2-23.1	7.7-23.8	24.6-50.8	0.36-2.98	0.09-0.35
S.D.		3.2	3.5	5.2	0.47	0.07
3	98					
Mean		11.5	12.5	37.4	1.08	0.17
Range		6.6-28.5	6.1-22.1	26.4-47.4	0.31-2.51	0.09-0.35
S.D.		3.8	3.8	4.3	0.49	0.06
4	95					
Mean		10.2	13.8	35.2	1.41	0.17
Range		6.2-15.0	4.6-21.2	24.4-53.5	0.42-2.57	0.06-0.30
S.D.		1.7	3.3	5.8	0.47	0.05
5	175					
Mean		11.0	12.7	36.1	1.15	0.17
Range		5.7-18.9	5.0-22.3	25.1-50.5	0.24-2.78	0.09-0.31
S.D.		2.7	3.3	5.3	0.53	0.05
6	724					
Mean		12.0	13.8	36.3	1.37	0.20
Range		5.9-28.2	5.7-23.8	22.2-51.4	0.15-3.23	0.07-0.37
S.D.		3.7	3.4	5.1	0.61	0.05
7	145					
Mean		12.1	13.4	37.1	1.15	0.20
Range		5.9-22.5	4.0-23.2	27.7-50.3	0.21-2.63	0.06-0.34
S.D.		3.7	3.9	4.9	0.55	0.06
8	422					
Mean		13.2	13.4	37.7	1.30	0.21
Range		6.5-29.4	6.0-21.9	20.2-53.4	0.32-3.05	0.08-0.35
S.D.		4.2	3.4	5.5	0.53	0.05
16	50					
Mean		12.6	12.1	38.4	1.08	0.18
Range		7.1-20.3	4.1-17.3	27.2-55.4	0.21-1.90	0.07-0.28
S.D.		3.3	3.3	5.3	0.46	0.04
18	34					
Mean		11.5	13.8	37.6	1.28	0.20
Range		4.4-27.0	7.7-25.7	28.9-54.5	0.55-2.70	0.10-0.32
S.D.		4.5	3.8	6.2	0.54	0.05
Provincial Total	2759					
Mean		11.8	13.7	36.7	1.31	0.20
Range		2.0-22.3	4.0-24.8	21.2-51.6	0.15-3.09	0.06-0.35
S.D.		3.5	3.6	5.2	0.56	0.05

Table 10. Regular feed analyses by SOIL AREA for LEGUME-GRASS HAY (moisture-free basis).

	Soil Area	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
	1	126					
Mean			10.4	14.0	36.2	1.19	0.19
Range			6.9-20.1	6.4-23.6	24.4-50.0	0.29-2.79	0.08-0.31
S.D.			2.5	4.2	4.7	0.51	0.06
	2	75					
Mean			11.2	16.5	35.3	1.42	0.22
Range			6.2-23.1	6.4-23.8	24.6-50.8	0.13-2.98	0.09-0.35
S.D.			3.1	3.7	5.3	0.52	0.06
	3	115					
Mean			11.3	12.1	37.7	1.01	0.17
Range			6.6-26.7	5.0-22.1	26.4-51.3	0.24-2.51	0.07-0.35
S.D.			3.3	3.9	4.6	0.50	0.06
	4	112					
Mean			10.1	13.4	35.4	1.34	0.17
Range			6.2-15.0	4.6-21.2	24.4-53.5	0.30-2.57	0.06-0.30
S.D.			1.8	3.5	5.8	0.51	0.05
	5	208					
Mean			11.3	12.3	36.5	1.08	0.17
Range			5.7-21.5	4.8-22.3	25.1-50.5	0.11-2.91	0.09-0.33
S.D.			3.0	3.4	5.1	0.55	0.05
	6	982					
Mean			11.8	13.1	36.7	1.19	0.19
Range			3.4-28.2	2.9-24.0	22.2-51.4	0.15-2.71	0.06-0.37
S.D.			3.7	3.7	5.0	0.58	0.05
	7	218					
Mean			12.6	12.7	38.5	1.09	0.20
Range			5.7-27.0	4.0-23.2	27.0-53.4	0.21-2.63	0.06-0.34
S.D.			4.1	3.8	5.4	0.53	0.06
	8	1069					
Mean			12.7	11.6	39.0	1.03	0.19
Range			5.6-28.8	3.2-21.9	20.2-54.7	0.28-2.64	0.04-0.37
S.D.			4.2	3.5	5.3	0.47	0.05
	16	144					
Mean			13.4	11.5	40.2	1.03	0.19
Range			6.9-27.5	4.1-17.3	27.2-55.4	0.21-2.06	0.07-0.30
S.D.			4.8	3.02	5.1	0.41	0.04
	18	118					
Mean			12.8	11.8	39.9	1.07	0.19
Range			4.4-28.8	4.2-22.4	28.9-54.5	0.27-2.43	0.05-0.45
S.D.			4.5	3.7	5.6	0.44	0.06
Provincial Total 4454							
Mean			12.1	12.7	37.6	1.44	0.19
Range			2.0-30.2	2.9-24.3	20.2-53.9	0.11-2.90	0.04-0.37
S.D.			4.1	3.8	5.3	0.55	0.05

Table 11. Regular feed analyses by SOIL AREA for OAT HAY
(moisture-free basis).

Soil Area	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
1	62					
Mean		12.9	10.4	32.4	0.34	0.22
Range		6.5-26.2	6.8-16.3	22.9-42.8	0.16-0.60	0.12-0.34
S.D.		4.9	2.5	4.3	0.11	0.06
2	16					
Mean		11.3	10.2	33.4	0.47	0.20
Range		8.6-18.3	6.8-14.2	20.4-43.3	0.18-1.13	0.05-0.27
S.D.		2.6	2.3	6.1	0.26	0.05
3	45					
Mean		13.7	9.7	35.4	0.32	0.21
Range		6.3-28.0	5.0-16.0	22.9-46.0	0.10-0.72	0.08-0.32
S.D.		6.5	2.8	5.4	0.14	0.06
4	24					
Mean		10.8	10.1	36.3	0.34	0.17
Range		6.3-20.8	5.0-17.8	28.6-48.0	0.21-0.54	0.05-0.27
S.D.		3.2	3.0	5.2	0.09	0.05
5	122					
Mean		9.3	10.6	31.7	0.36	0.20
Range		4.9-29.9	5.2-17.5	21.1-46.0	0.11-0.77	0.10-0.34
S.D.		5.2	2.4	5.0	0.14	0.04
6	143					
Mean		11.6	9.7	36.6	0.38	0.20
Range		3.0-26.2	4.2-17.6	22.2-48.3	0.09-0.88	0.08-0.48
S.D.		5.1	2.6	4.5	0.16	0.07
7	44					
Mean		12.9	7.6	37.2	0.31	0.21
Range		6.3-23.1	3.8-12.7	23.6-46.4	0.15-0.72	0.09-0.33
S.D.		4.3	2.3	5.5	0.15	0.06
8	114					
Mean		13.9	8.3	37.6	0.36	0.20
Range		5.9-27.0	3.5-16.4	19.7-51.1	0.12-0.77	0.11-0.34
S.D.		5.6	2.5	5.1	0.14	0.05
16	8					
Mean		13.8	7.2	37.6	0.37	0.21
Range		7.4-22.1	4.6-10.4	31.4-46.9	0.20-0.70	0.14-0.28
S.D.		6.6	2.2	5.6	0.18	0.05
18	13					
Mean		11.9	8.0	34.8	0.47	0.22
Range		6.1-18.8	3.8-10.8	29.1-46.9	0.18-12.6	0.15-0.29
S.D.		4.4	1.9	5.6	0.30	0.04
Provincial Total	760					
Mean		11.5	9.4	35.4	0.36	0.21
Range		2.8-24.9	2.3-17.8	19.7-51.1	0.08-0.89	0.03-0.38
S.D.		4.8	2.7	5.5	0.14	0.06

Table 12. Regular feed analyses of CEREAL SILAGES (moisture free basis).

Feed Type	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
<u>CEREALS</u>						
Barley	544	Mean	10.9	32.5	0.52	0.27
		Range	5.7-18.8	7.5-46.7	0.10-1.11	0.11-0.45
		S.D.	2.5	5.0	0.18	0.06
Oats	172	Mean	10.0	36.2	0.49	0.24
		Range	4.0-16.7	23.1-49.8	0.20-1.04	0.10-0.37
		S.D.	2.3	4.7	0.17	0.05
Corn	89	Mean	8.8	31.4	0.37	0.23
		Range	5.3-13.8	21.2-42.2	0.04-0.92	0.13-0.38
		S.D.	1.7	4.2	0.17	0.05
Mixed Cereal	124	Mean	10.1	36.5	0.57	0.26
		Range	6.3-14.1	9.5-52.5	0.23-1.6	0.16-0.41
		S.D.	1.8	6.5	0.26	0.05
Trittleale	27	Mean	10.6	33.2	0.35	0.24
		Range	6.5-18.4	25.4-45.6	0.22-0.79	0.16-0.37
		S.D.	2.8	4.6	0.12	0.05

Table 13. Regular feed analyses of LEGUME SILAGES (moisture-free basis).

Feed Type	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
<u>LEGUMES</u>						
<u>Alfalfa</u>						
	286					
Mean		53.7	17.7	36.7	1.86	0.25
Range		6.7-86.7	5.0-25.6	4.4-52.2	0.48-3.12	0.09-0.40
S.D.		14.9	3.2	6.2	0.48	0.05
<u>Clover (unsp.)</u>						
	97					
Mean		61.2	14.3	44.4	1.51	0.21
Range		31.3-82.5	9.1-20.0	32.6-59.6	0.43-2.4	0.05-0.34
S.D.		11.6	2.1	6.0	0.34	0.05
<u>Red Clover</u>						
	63					
Mean		61.6	14.4	44.7	1.52	0.20
Range		32.3-82.5	9.1-20.0	32.6-59.4	0.43-2.41	0.05-0.34
S.D.		12.3	2.0	6.1	0.35	0.05
<u>Sweet Clover</u>						
	27					
Mean		64.4	15.6	40.2	1.52	0.22
Range		32.2-81.9	10.1-24.3	28.0-57.5	0.90-2.22	0.04-0.36
S.D.		12.2	2.8	6.4	0.32	0.06
<u>Fababeans</u>						
	39					
Mean		69.4	17.2	38.2	1.10	0.28
Range		52.2-85.0	12.7-24.1	24.1-55.1	0.70-1.83	0.19-0.41
S.D.		7.5	2.5	5.6	0.24	0.06

Table 14. Regular feed analyses of GRASS and GRASS-LEGUMES MIXTURES and OTHER SILAGES (moisture-free basis).

Feed Type	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
<u>GRASS & GRASS-LEGUMES MIXTURES</u>						
Grass (unsp.)	39					
Mean		64.6	14.9	38.1	1.00	0.28
Range		40.5-83.5	7.7-29.7	23.8-53.6	0.47-2.21	0.13-0.68
S.D.		10.4	6.2	6.6	0.43	0.14
Legume-Grass	583					
Mean		55.8	14.1	39.2	1.39	0.23
Range		12.0-85.7	7.1-23.0	24.3-53.4	0.31-2.94	0.05-0.39
S.D.		13.1	3.0	5.0	0.49	0.05
Alfalfa-Grass	59					
Mean		55.0	14.5	38.4	1.55	0.23
Range		25.5-76.2	8.7-23.8	25.2-49.7	0.52-3.09	0.15-0.39
S.D.		11.7	3.3	4.6	0.62	0.05
Silage (unsp.)	548					
Mean		61.8	11.9	37.4	0.88	0.25
Range		26.6-96.9	5.0-21.4	16.8-57.4	1.70-2.49	0.09-0.42
S.D.		11.0	3.1	6.2	0.51	0.06
<u>OTHER SILAGES</u>						
Sunflower	9					
Mean		76.3	12.0	38.2	1.38	0.24
Range		67.3-84.7	6.6-13.9	28.7-48.2	1.01-1.62	0.17-0.38
S.D.		5.7	2.3	8.1	0.21	0.06

Table 15. Regular feed analyses by SOIL AREA for BARLEY SILAGE (moisture-free basis).

	Soil Area	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
Mean	1	4	67.0	11.5	30.5	0.61	0.29
Range			57.9-74.2	8.1-14.5	25.5-3.5	0.43-0.87	0.26-0.31
S.D.			7.1	2.8	3.5	0.19	0.02
Mean	2	39	64.1	11.6	33.6	0.59	0.28
Range			39.7-81.7	7.5-16.4	26.6-44.8	0.28-1.38	0.14-0.52
S.D.			9.3	2.3	5.0	0.25	0.07
Mean	3	18	59.1	11.2	28.3	0.41	0.25
Range			51.2-65.7	8.1-14.3	22.0-34.9	0.22-0.59	0.16-0.40
S.D.			4.2	1.9	4.3	0.11	0.07
Mean	4	10	61.0	12.4	30.8	0.51	0.25
Range			46.9-69.6	6.1-16.9	20.6-38.1	0.28-0.92	0.18-0.39
S.D.			7.1	3.3	5.0	0.19	0.06
Mean	5	22	62.5	11.6	30.0	0.48	0.25
Range			43.2-73.2	7.4-16.3	23.0-36.1	0.28-0.82	0.18-0.37
S.D.			7.0	1.8	3.9	0.15	0.05
Mean	6	135	57.2	10.9	32.3	0.56	0.26
Range			6.0-77.2	6.9-18.2	19.1-49.6	0.22-1.07	0.17-0.42
S.D.			18.6	2.3	5.6	0.17	0.05
Mean	7	15	63.0	11.6	32.6	0.57	0.27
Range			13.5-79.3	7.4-18.0	27.9-41.0	0.30-1.45	0.19-0.48
S.D.			14.8	2.9	4.1	0.30	0.08
Mean	8	23	64.3	10.1	34.4	0.59	0.28
Range			53.5-71.5	6.7-15.6	21.8-41.0	0.36-1.11	0.20-0.42
S.D.			5.0	2.1	4.7	0.18	0.06
Mean	16	6	61.9	8.9	32.7	0.51	0.26
Range			58.1-66.3	7.3-10.8	30.1-37.2	0.31-0.81	0.19-0.36
S.D.			3.5	1.5	2.6	0.18	0.06
Mean	18	4	53.0	10.6	26.4	0.41	0.28
Range			36.0-69.4	8.4-12.9	10.0-36.4	0.10-0.75	0.20-0.41
S.D.			15.0	2.2	11.4	0.27	0.10
Provincial Total		544					
Mean			60.5	10.9	32.5	0.52	0.27
Range			5.8-87.6	5.7-18.8	7.5-46.7	0.10-1.11	0.11-0.45
S.D.			15.0	2.5	5.0	0.18	0.06

Table 16. Regular feed analyses by SOIL AREA for LEGUME-GRASS SILAGE (moisture-free basis).

Soil Area	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
1	5					
Mean		59.5	12.4	42.4	0.99	0.22
Range		48.7-74.1	8.2-18.0	38.0-49.1	0.48-1.63	0.15-0.29
S.D.		9.5	4.4	4.2	0.52	0.06
2	6					
Mean		54.7	17.0	39.8	1.51	0.26
Range		44.7-65.8	14.6-19.8	33.9-44.9	1.04-1.97	0.21-0.31
S.D.		7.0	2.3	3.6	0.36	0.03
3	8					
Mean		54.0	16.4	40.9	1.43	0.23
Range		36.2-69.8	13.1-20.4	34.9-45.6	1.01-2.08	0.17-0.27
S.D.		11.7	2.2	3.4	0.32	0.04
4	8					
Mean		63.7	14.9	40.7	1.50	0.23
Range		58.6-73.8	10.9-19.5	28.7-53.4	0.71-2.43	0.15-0.29
S.D.		5.2	3.5	7.4	0.60	0.06
5	14					
Mean		51.6	15.0	35.2	1.28	0.23
Range		27.4-70.3	10.8-18.3	19.6-47.5	0.91-1.75	0.15-0.29
S.D.		13.7	2.1	8.5	0.23	0.04
6	141					
Mean		54.3	14.6	38.7	1.55	0.24
Range		8.2-85.3	7.1-23.8	5.5-52.0	0.60-3.30	0.14-0.39
S.D.		13.9	3.4	5.8	0.57	0.06
7	24					
Mean		60.9	13.3	41.3	1.32	0.21
Range		7.8-77.4	8.6-19.3	29.3-47.3	0.55-2.22	0.15-0.42
S.D.		15.1	4.1	4.1	0.38	0.06
8	167					
Mean		54.2	13.6	38.9	1.35	0.22
Range		13.3-85.7	4.5-21.8	28.1-51.6	0.39-2.84	0.12-0.39
S.D.		13.7	3.1	5.3	0.49	0.05
16	14					
Mean		63.2	14.6	39.1	1.36	0.22
Range		43.5-75.0	7.1-25.3	29.3-50.8	0.48-2.12	0.12-0.35
S.D.		10.8	4.4	5.9	0.48	0.05
18	18					
Mean		62.0	15.6	37.9	1.58	0.24
Range		45.0-77.6	9.7-20.1	32.6-52.7	0.62-2.60	0.16-0.32
S.D.		8.7	3.2	5.0	0.58	0.04
Provincial Total	583					
Mean		55.8	14.1	39.2	1.39	0.23
Range		12.0-85.7	7.1-23.0	24.3-53.4	0.31-2.94	0.05-0.39
S.D.		13.1	3.0	5.0	0.49	0.05

Table 17. Regular feed analyses of CEREALS and OTHER STRAWS (moisture-free basis).

Feed Type	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
<u>CEREALS</u>						
Barley	370	Mean	11.1	4.7	49.1	0.47
		Range	4.1-42.6	1.3-10.5	30.9-60.6	0.06-0.94
		S.D.	6.3	1.6	5.7	0.15
Oats	362	Mean	11.3	4.5	46.5	0.38
		Range	3.5-32.1	1.1-11.3	29.5-58.1	0.07-0.88
		S.D.	4.8	2.0	5.6	0.15
Wheat	116	Mean	8.9	3.9	50.4	0.31
		Range	3.9-28.8	1.4-15.7	34.5-61.0	0.06-1.30
		S.D.	3.7	2.3	4.9	0.15
Mixed Cereal	42	Mean	15.4	6.3	47.8	0.45
		Range	9.9-44.1	1.4-14.6	28.9-57.0	0.14-0.67
		S.D.	9.9	3.7	6.8	0.13
<u>OTHER STRAWS</u>						
Flax	13	Mean	10.6	4.3	60.5	0.62
		Range	6.7-22.0	2.2-8.6	37.2-67.7	0.40-1.12
		S.D.	4.7	1.6	7.6	0.21

Table 18. Regular feed analyses of CHAFFS (moisture-free basis).

Feed Type	Number of Samples	Moisture (%)	Protein (%)	Fibre(ADF) (%)	Calcium (%)	Phosphorus (%)
CEREALS						
Barley						
	13					
Mean		11.3	6.5	35.0	0.64	0.14
Range		7.1-23.4	3.8-13.2	28.6-40.1	0.37-1.15	0.05-0.31
S.D.		4.3	3.0	3.1	0.20	0.08
Wheat						
	8					
Mean		9.4	4.6	42.0	0.34	0.10
Range		6.8-12.3	3.9-5.0	37.7-44.4	0.23-0.65	0.05-0.15
S.D.		2.1	0.42	2.1	0.15	0.03

Table 19. Regular feed analyses of SCREENINGS (moisture-free basis).

Feed Type	Number of Samples	Moisture (%)	Protein (%)	Calcium (%)	Phosphorus (%)
<u>CEREALS</u>					
Barley	11	Mean	11.0	0.50	0.40
		Range	6.3-14.0	0.07-1.45	0.13-0.85
		S.D.	2.0	0.53	0.20
Mixed Cereal	19	Mean	14.8	0.54	0.41
		Range	9.8-22.3	0.05-1.72	0.23-0.53
		S.D.	2.8	0.45	0.08
<u>OTHER SCREENINGS</u>					
Rapeseed	21	Mean	15.3	0.93	0.47
		Range	8.9-22.9	0.11-2.14	0.19-0.84
		S.D.	3.6	0.47	0.15

Table 20. Carotene content in HAYS (moisture-free basis).

Feed Type	Number of Samples	Carotene Content (mg/lb)		S.D.
		Mean	Range	
Alfalfa	713	36.9	0.3-113.5	27.0
Clover (unsp.)	28	12.7	1.2-55.6	13.8
Red Clover	14	14.7	3.1-39.8	14.1
Alsike Clover	7	5.8	3.0-8.8	2.1
Legume-Grass	882	15.2	0.5-121.8	13.1
Alfalfa-Grass	593	16.2	0.5-71.5	12.7
Grass (unsp.)	23	13.8	1.7-49.8	10.7
Native Grass	26	16.4	0.3-60.0	17.1
Slough Grass	17	20.2	3.3-52.7	14.4
Brome Grass	43	11.1	0.5-41.4	8.4
Timothy	31	12.3	0.9-45.1	9.1
Barley	17	10.2	0.3-59.6	16.4
Oats	65	11.5	0.2-50.6	11.2
Mixed Cereal	9	12.0	0.6-31.5	10.0

Table 21. Carotene content in SILAGES (moisture-free basis).

Feed Type	Number of Samples	Carotene Content (mg/lb)		
		Mean	Range	S.D.
Barley	70	9.4	0.5-55.9	9.3
Oats	41	9.9	0.3-30.0	8.0
Corn	9	4.3	0.3-15.4	5.0
Mixed Cereal	6	8.7	3.3-20.2	6.1
Hay	62	16.2	1.1-77.9	14.5
Alfalfa	26	19.8	1.4-62.6	14.5
Clover (unsp.)	13	15.6	0.5-44.7	14.7
Red Clover	6	19.7	4.5-36.1	13.4
Legume-Grass	118	20.7	0.2-84.8	14.2
Alfalfa-Grass	16	14.6	5.1-38.8	8.4
Fababeans	5	12.9	3.4-24.6	8.0

Trace Mineral Survey 1971-1974

Pages 29 to 34 were published in the Canadian Journal of Animal Science, reference 4. The maps following these tables, pages 35 and 36, are an extension of this data survey. Other maps showing the distribution of elements iron, copper and zinc are available upon request.

Pages 37 to 39 are the summary data of macro and micro mineral analyses completed between the years 1979 and 1981. References 6, 7 and 8.

Publications containing trace mineral data of Alberta feedstuffs can be obtained from the following:

1. Dudas, M.J. & Pawluk, S. 1977. Heavy metals in cultivated soils and in cereal crops in Alberta. Can. J. Soil Sci. 57: 329-339.
2. Horton, G.M.J. & McElroy, L.W. 1977. Nutrition value of sedge and Kentucky bluegrass hays grown in Alberta. Can J. Anim. Sci. 57: 187-193.
3. Martin, P.J. & Massey, D.L. 1973. Selenium deficiency in Alberta. Canadex 400.65.
4. Redshaw, E.S., Martin, P.J. and Laverty, D.H. 1978. Iron, manganese, copper, zinc and selenium concentrations in Alberta grains and roughages. Can. J. Anim. Sci. 58: 553-558.
5. Walker, D.R. 1971. Selenium in forage species in Central Alberta. Can. J. Soil Sci. 51: 506-508.
6. Weisenburger, R.D. 1981. Levels of trace minerals found in Alberta feeds. Proceedings 2nd Western Nutrition Conference. Edmonton, Canada, September 15-17, 1981.
7. Westra, R. 1981. Hoof problems in cattle - is there a relationship with trace mineral levels. Proceedings 2nd Western Nutrition Conference. Edmonton, Canada, September 15-17, 1981.
8. Westra, R. 1982. Sulfur and other mineral concentrations in feedstuffs fed to livestock in various regions of Alberta. Symposium: Acid Forming Emission in Alberta and Their Ecological Effects. Edmonton, Canada, March 9-12, 1982.

Table 1. Types of feedstuffs and numbers of samples analyzed for micro minerals for 1971-1974 survey.

Feedstuff	Numbers of samples on which analyses were performed				
	Fe	Mn	Cu	Zn	Se
Wheat grain	69	69	69	69	--
Barley grain	377	376	377	375	428
Oat grain	222	222	222	222	--
Barley roughage	123	123	123	123	--
Oat roughage	253	253	253	253	--
Barley-Oat roughage	158	158	158	158	--
Grass roughage	88	88	88	88	--
Legume roughage	144	144	144	144	--
Grass-Legume roughage	573	573	573	573	143

Table 2. Percent distribution of iron concentrations (ppm) within various ranges in feedstuffs in 1971-1974 survey.

Feedstuff	Range	Mean \pm SE*	Percent distribution of samples in iron concentration ranges		
			0-30	31-60	61+
Wheat grain	29- 810	70 \pm 11	2	74	24
Barley grain	24- 532	94 \pm 3	0	16	84
Oat grain	29- 542	74 \pm 4	1	48	51
Barley roughage	16-1758	208 \pm 25	1	7	92
Oat roughage	26-2641	141 \pm 15	0	17	83
Barley-Oat roughage	26-7042	330 \pm 60	1	7	91
Grass roughage	37-1268	165 \pm 17	0	13	87
Legume roughage	22-1567	182 \pm 16	1	2	97
Grass-Legume roughage	33-1767	161 \pm 12	0	11	89

* SE = Standard Error

Table 3. Percent distribution of manganese concentrations (ppm) within various ranges in feedstuffs in 1971-1974 survey.

Feedstuff	Range	Mean \pm SE*	Percent distribution of samples in manganese concentration ranges		
			0-40	41-80	81+
Wheat grain	23- 75	41 \pm 1	55	45	0
Barley grain	7-116	21 \pm 1	94	5	1
Oat grain	15-107	48 \pm 1	35	62	3
Barley roughage	4-369	35 \pm 3	81	17	2
Oat roughage	4-168	45 \pm 2	49	42	9
Barley-Oat roughage	12-199	50 \pm 2	42	47	11
Grass roughage	11-635	91 \pm 11	33	37	30
Legume roughage	11- 86	25 \pm 3	72	28	0
Grass-Legume roughage	10-191	49 \pm 2	49	42	9

* SE = Standard Error

Table 4. Percent distribution of copper concentrations (ppm) within various ranges in feedstuffs in 1971-1974 survey.

Feedstuff	Range	Mean \pm SE*	Percent distribution of samples in copper concentration ranges		
			0-10	11-20	21+
Wheat grain	2-26	8 \pm 1	84	15	1
Barley grain	1-68	13 \pm 1	54	26	20
Oat grain	1-72	17 \pm 1	28	36	36
Barley roughage	1-70	14 \pm 1	27	60	13
Oat roughage	1-29	11 \pm 1	44	51	5
Barley-Oat roughage	1-36	12 \pm 1	42	52	6
Grass roughage	1-24	12 \pm 1	33	64	3
Legume roughage	1-47	11 \pm 1	47	51	2
Grass-Legume roughage	2-46	12 \pm 1	46	52	2

* SE = Standard Error

Table 5. Percent distribution of zinc concentrations (ppm) within various ranges in feedstuffs in 1971-1974 survey.

Feedstuff	Range	Mean \pm SE*	Percent distribution of samples in zinc concentration ranges		
			0-50	51-100	101+
Wheat grain	24- 77	43 \pm 1	75	25	0
Barley grain	21-197	44 \pm 1	79	20	1
Oat grain	23-113	41 \pm 1	90	10	0
Barley roughage	6- 85	30 \pm 1	98	2	0
Oat roughage	6-108	27 \pm 1	96	3	1
Barley-Oat roughage	13- 74	31 \pm 1	96	4	0
Grass roughage	17- 92	33 \pm 1	88	12	0
Legume roughage	10- 80	30 \pm 1	98	2	0
Grass-Legume roughage	3-122	32 \pm 1	96	4	0

* SE = Standard Error

Table 6. Percent distribution of selenium concentrations (ppb) within various ranges in feedstuffs in 1971-1974 survey.

Feedstuff	Range	Mean \pm SE*	Percent distribution of samples in selenium concentration ranges		
			0-100	101-200	201+
Barley grain	5-2213	211 \pm 12	41	24	35
Grass-Legume roughage	2-2000	176 \pm 24	50	31	19

* SE = Standard Error

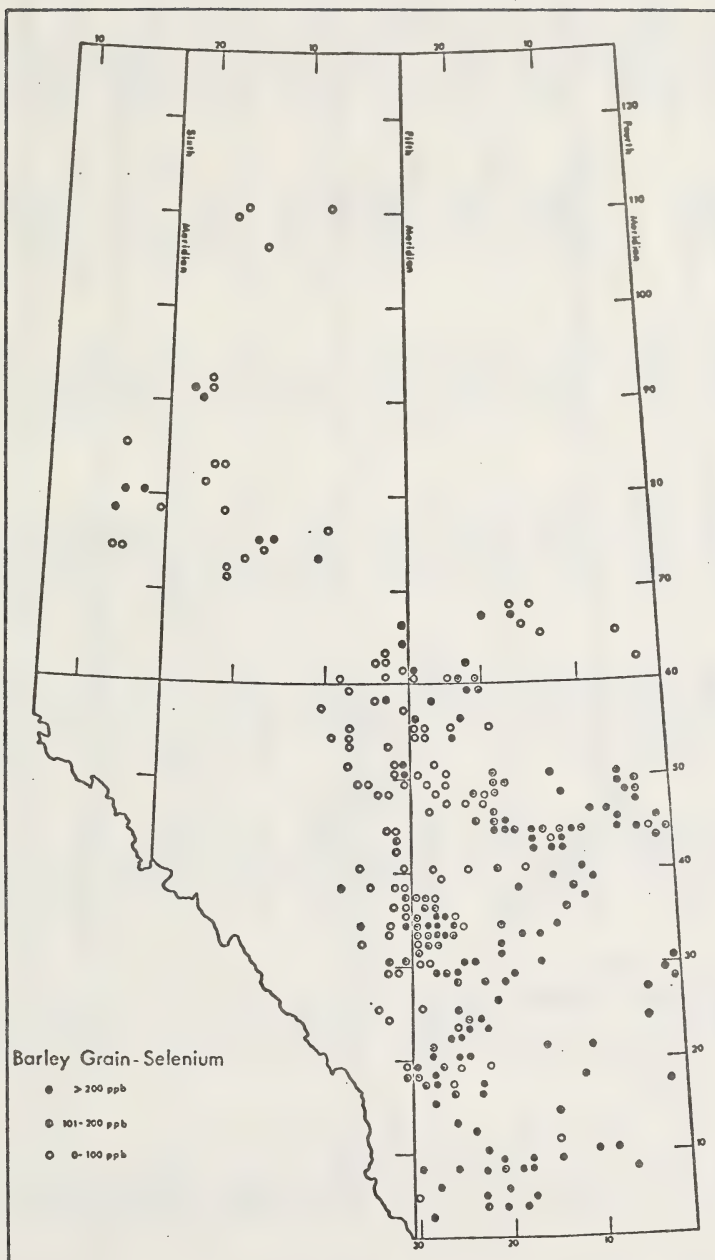


Figure 1. Geographic distribution of selenium concentrations (ppb) in barley grain in 1971-1974 survey.

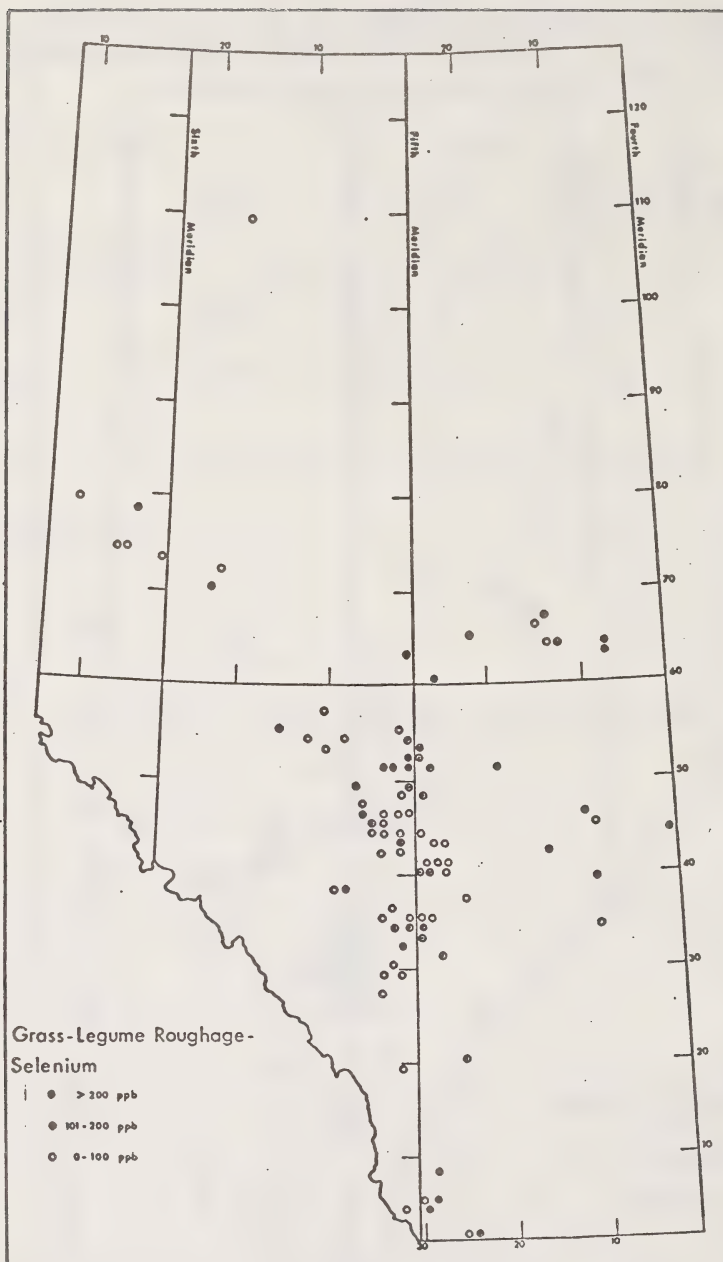


Figure 2. Geographic distribution of selenium concentrations (ppb) in grass-legume roughage in 1971-1974 survey.

Table 7. MACRO MINERALS OF ALBERTA FEEDSTUFFS OCTOBER 1969 - JULY 1981

Feedstuffs	ADF %	CP %	Ca %	P %	Mg %	K %	Na %	S %
GRAINS	Mean	12.0	0.08	0.37	0.139	0.51	0.018	0.100
	S.D.	(1.9)	(0.03)	(0.05)	(0.016)	(0.10)	(0.016)	(0.019)
	Range	8.0-16.8	0.03-0.24	0.27-0.53	0.09-0.19	0.31-0.75	0.000-0.068	0.07-0.15
CEREAL HAY	Mean	9.3	0.33	0.21	0.158	1.85	0.187	0.149
	S.D.	(4.7)	(0.15)	(0.05)	(0.041)	(0.58)	(0.167)	(0.069)
	Range	5.4-13.3	0.14-0.82	0.12-0.32	0.09-0.24	1.0-2.82	0.042-0.541	0.010-0.280
GRASS HAYS	Mean	9.2	0.50	0.15	0.156	1.25	0.125	0.166
	S.D.	(3.7)	(0.30)	(0.07)	(0.076)	(0.63)	(0.302)	(0.118)
	Range	3.5-19.3	0.14-2.08	0.03-0.29	0.060-0.380	0.17-2.58	0.001-1.376	0.070-0.540
LEGUME HAYS	Mean	17.2	1.73	0.21	0.297	2.14	0.066	0.176
	S.D.	(3.3)	(0.45)	(0.05)	(0.092)	(0.61)	(0.083)	(0.061)
	Range	7.3-24.5	0.39-3.08	0.09-0.34	0.050-0.520	1.27-3.48	0.004-0.421	0.070-0.310
GRASS-LEGUME HAY	Mean	12.9	1.05	0.19	0.215	1.78	0.059	0.154
	S.D.	(5.4)	(0.59)	(0.06)	(0.088)	(0.61)	(0.144)	(0.073)
	Range	3.5-24.5	0.14-3.08	0.03-0.42	0.05-0.52	0.14-3.48	0.001-1.376	0.050-0.540
STRAWS	Mean	4.4	0.31	0.10	0.120	1.55	0.247	0.135
	S.D.	(4.9)	(0.23)	(0.05)	(0.046)	(0.52)	(0.260)	(0.050)
	Range	2.5-7.2	0.09-1.12	0.02-0.25	0.06-0.23	0.34-2.49	0.007-0.854	0.090-0.270
CEREAL SILAGE	Mean	10.6	0.49	0.26	0.195	1.52	0.311	0.169
	S.D.	(2.0)	(0.29)	(0.04)	(0.047)	(0.38)	(0.198)	(0.048)
	Range	6.1-14.6	0.24-1.62	0.20-0.37	0.12-0.33	1.01-2.34	0.147-0.548	0.13-0.26
LEGUME SILAGE	Mean	16.8	1.61	0.25	0.314	2.29	0.042	0.110
	S.D.	(2.9)	(0.32)	(0.05)	(0.055)	(0.50)	(0.035)	(0.120)
	Range	12.9-19.8	0.97-2.12	0.15-0.35	0.240-0.460	1.21-3.25	0.004-0.114	0.100-0.120
GRASS SILAGE	Mean	14.3	0.93	0.26	0.240	1.45	0.135	0.135
	S.D.	(5.7)	(0.33)	(0.07)	(0.104)	(1.05)	(0.064)	(0.064)
	Range	36.2-47.6	0.64-1.29	0.19-0.32	0.17-0.36	0.24-2.15	0.09-0.18	
LEGUME GRASS SILAGE	Mean	15.4	1.40	0.24	0.289	2.16	0.039	0.146
	S.D.	(2.5)	(0.44)	(0.05)	(0.089)	(0.52)	(0.032)	(0.061)
	Range	31.2-51.4	0.20-2.12	0.15-0.36	0.16-0.58	0.24-3.25	0.004-0.114	0.09-0.29

* This value is not acid detergent fiber, but crude fiber, for grain only.

** Standard Deviation

ADF = Acid Detergent Fiber
 CP = Crude Protein
 Ca = Calcium
 P = Phosphorus
 Mg = Magnesium
 K = Potassium
 Na = Sodium
 S = Sulfur

Table 8. MICRO MINERALS OF ALBERTA FEEDSTUFFS OCTOBER 1969 - JULY 1981

Feedstuffs	Se ppm	Cu ppm	Mn ppm	Zn ppm	Mo ppm	Al ppm	Cd ppm	Fe ppm
GRAINS	Mean S.D. Range	7.4 (12.6) 0.5-145.0	29.2 (14.7) 11.7-75.6	37.9 (14.9) 18.7-159.1	0.643 (0.443) 0.08-1.49	23.3 (20.3) 5-93	0.37 (0.13) 0.167-0.554	81 (47) 41-348
CEREAL HAY	Mean S.D. Range	4.7 (1.9) 1.7-8.5	39.5 (15.9) 17.2-67.6	20.5 (6.8) 10.2-37.9	0.562 (0.333) 0.09-1.13	957 (2419) 30-6942	0.176 (0.053) 0.139-0.214	126 (77) 42-312
GRASS HAYS	Mean S.D. Range	5.6 (3.1) 0.012-1.872	72.6 (59.9) 8.4-307.6	22.6 (11.3) 5.9-76.5	1.298 (0.779) 0.250-3.850	869 (1372) 25-5656		346 (368) 1-2213
LEGUME HAYS	Mean S.D. Range	8.0 (2.6) 0.030-1.440	35.6 (13.1) 12.2-66.8	21.9 (6.7) 8.2-40.3	1.671 (1.159) 0.120-4.470	199 (167) 28-591		187 (123) 48-754
GRASS-LEGUME HAY	Mean S.D. Range	6.8 (3.3) 0.012-3.172	52.8 (38.6) 8.4-30.8	23.6 (9.8) 5.9-109.3	1.329 (0.798) 0.12-4.47	542 (1240) 19-7117	0.266 (0.062) 0.194-0.307	237 (271) 1-2213
STRAWS	Mean S.D. Range	3.6 (2.0) 0.021-1.218	31.9 (23.3) 8.4-91.9	13.3 (6.8) 2.6-23.9	0.720 (0.491) 0.23-1.81	90.7 (48.2) 32-204	0.231 (0.007) 0.226-0.236	113 (52) 53-198
CEREAL SILAGE	Mean S.D. Range	5.2 (2.0) 0.025-0.410	37.4 (9.5) 23.6-50.0	27.4 (11.5) 11.0-59.1	1.350 (0.494) 0.780-1.660	150 (67) 102-197		258 (170) 134-539
LEGUME SILAGE	Mean S.D. Range	8.3 (3.1) 0.048-0.580	33.6 (13.5) 14.0-62.4	27.5 (5.8) 13.5-34.3	1.355 (0.728) 0.84-1.87	1161 (116) 1079-1243		241 (266) 100-1019
GRASS SILAGE	Mean S.D. Range	7.3 (0.8) 0.048-0.496	61.6 (39.7) 33.5-89.7	29.9 (0.57) 29.5-30.3				
LEGUME GRASS SILAGE	Mean S.D. Range	9.4 (9.8) 0.040-0.580	43.0 (18.1) 14.0-98.1	23.9 (7.8) 13.5-56.4	1.160 (0.616) 0.77-1.87	1006 (281) 695-1243		234 (219) 100-1019

Se = Selenium
Cu = Copper
Mn = Manganese
Zn = Zinc
Mo = Molybdenum
Al = Aluminum
Cd = Cadmium
Fe = Iron

Table 9. Percent Alberta feedstuffs with mineral concentrations below the recommended (1R) and twice the recommended (2R) mineral requirements for pregnant and dry beef cows within the soil areas of Alberta (October 1979 - July 1981).

Soil Zone	Recommended Mineral Levels (ppm)	S	Se	Cu	Mn	Zn	Mo	Fe
		1000	0.1	10	40	50	0.5	50
1	1R 2R	20 40	12 33	98 100	29 75	100	33 33	2 6
2	1R 2R	0 100	29 71	80 100	80 100	60 100	-- --	0 0
6	1R 2R	53 87	47 85	93 98	63 94	96 98	11 67	20 52
7	1R 2R	0 100	33 80	81 100	59 94	94 100	-- --	- -
8	1R 2R	23 100	63 84	80 99	34 86	98 100	50 87	0 0
16	1R 2R	43 86	27 73	100	80 90	80 100	43 43	33 33
18	1R 2R	33 100	100	67 83	50 83	100	20 20	100

Feedstuffs refers to both grains and roughages.

N.L.C. - B.N.C.



3 3286 05548650 6